REMARKS

In response to the Office Action mailed November 8, 2004, the Applicant respectfully requests that the Examiner consider the following remarks. The remarks address the Examiner's Response to Arguments section of the Office Action. Claims 1-56 are unchanged and remain pending in the application. The Applicant respectfully requests further examination and reconsideration of the application in light of the remarks.

Withdrawal of Rejection of Claims 1-56 Under 35 U.S.C. § 112

The Applicant appreciates the Examiner's withdrawal of the claim rejections under 35 USC § 112 as described in the Office Action mailed on February 20, 2004, in view of the amendment filed on August 20, 2004.

Rejections of Claims 1-56 Under 35 U.S.C. § 103(a)

The Examiner rejected claims 1-3, 7, 8, 10-17, 19-29, and 33-56 under 35 U.S.C. § 103(a) as being unpatentable over Gamson (US-PAT-NO: 3,684,697) in view of DE 19540780A1. Claims 9 and 18 were also rejected under 35 U.S.C. § 103(a) as being unpatentable over Gamson (US-PAT-NO: 3,684,697) in view of DE 19540780A1 as applied to claims 1 and 17 above, and further in view of Wasson et al. (US-PAT-NO: 4,388,152). Claims 4-6 and 30-32 were also rejected under

35 U.S.C. § 103(a) as being unpatentable over Gamson (US-PAT-NO: 3,684,697) in view of DE 19540780A1 as applied to claims 1 and 17 above, and further in view of Yan (US-PAT-NO: 4,096,097). The Applicant respectfully traverses these rejections.

Claims 1-3, 7, 8, 10-17, 19-29, and 33-56 are NOT obvious over Gamson (US-PAT-NO: 3,684,697) in view of DE 19540780A1. Gamson (US-PAT-NO: 3,684,697) teaches a feedstock dilution method of the delayed coking process to produce sponge coke suitable for the manufacture of graphite and carbon electrodes used in the aluminum industry. Hydrocarbon bottoms which have low asphaltenes contents (e.g., below about 8 %) are added to coking feedstocks with asphaltenes content above about 13 % (as measured by ASTM D2006). Gamson teaches that the dilution of the asphaltenes content below 13 % (on its own) is sufficient to effect a change of coke crystalline structure from shot coke production to sponge coke production. Gamson does not teach that an asphaltenes content of less than 13% in the coking feedstock can still form shot coke (desolutation of asphaltenes and resins) if there are not sufficient levels of hydrocarbons (e.g., heavy aromatics) that behave as solvents for the asphaltenes. In other words, the ratio of asphaltenes to other aromatics in the coker feed is more critical to the formation of sponge coke than the absolute weight content of asphaltenes in the coker feed. Also, Gamson does not teach the role of resins in shot coke formation and their impact on its dilution method. Furthermore, Gamson's

addition of such materials to the coker feed to reduce asphaltene content does not cause the resulting coke to have VCM amounts within the claimed ranges of this application nor improve the adsorption characteristics of the resulting coke above and beyond that of traditional, sponge coke. The Applicant respectfully submits that Gamson provides neither means nor incentive to produce a coke with VCM content outside the traditional range of 8–12 wt.% for pet coke that is calcined to remove excess VCM and hydrogen for the manufacture of graphite and carbon electrodes used in the aluminum industry. That is, VCM content greater than 12 wt.% would be objectionable for the calcination process of this metallurgical coke (vs. fuel coke). Though the resulting coke will have improved adsorption characteristics over shot coke, Gamson's resulting coke will not attain the improved adsorption characteristics of the current invention without employing the methods of the current invention. In contrast, the current invention specifically discusses these issues in its specification and clearly differentiates over Gamson in these regards. The current invention teaches methods (primarily operating conditions) to maintain the proper ratio of asphaltic coking to thermal (aromatics) coking to produce sponge coke preferentially over shot coke for a given process feed. In fact, these methods can produce very porous sponge coke from process feedstocks that normally produce shot coke in traditional coking processes. The primary method controls the coke quality via thermal cracking process operating conditions; primarily reducing the coke drum temperature (e.g., lower heater outlet

temperature and/or coking cycle quench). The current invention also teaches further increasing the porosity of the sponge coke by other process means. In addition, the current invention teaches methods (primarily operating conditions) to increase VCM levels and adsorption characteristics above and beyond traditional, sponge coke. These methods (see claim 46) also include the addition of certain 'additives' to affect the coking mechanisms, NOT the asphaltene concentration in the feed. For example, the uniform addition of 'additives' to the coke precursor material changes the coking mechanism via the roles of aromatics (e.g., asphaltic to thermal coking ratio) and/or hydrogen as described in the specification of the current invention. In independent claim 1 of the current invention, the claim language provides a step to "promote the production of sponge coke" (i.e. traditional, sponge coke). An additional step is included for "increasing porosity or improving adsorption characteristics of said sponge coke by a process means in said thermal cracking process" (i.e., above and beyond traditional, sponge coke; NOT vs. shot coke). Claim 17 includes similar limitations. Thus, the Applicant respectfully submits that this claim language distinguishes over the process disclosed by Gamson. Since the independent claims of the current invention are distinguished over Gamson, all claims are distinguished over Gamson.

In addition, Gamson does not teach producing a porous, sponge coke for the addition of other chemical compounds (e.g., sulfur adsorbents) for the specific purpose of improving the pet coke's combustion characteristics and environmental impacts.

Instead, Gamson teaches the production of sponge coke with characteristics favorable for the manufacture of graphite and carbon electrodes used in the aluminum industry. In contrast, the current invention teaches various methods to uniformly distribute various selected chemical compounds within the porous sponge coke via the coke quench media to improve pet coke fuel properties, combustion characteristics, and environmental impacts from the combustion of the resultant modified coke. These methods provide the means to control the quality and quantity of the 'chemical compounds' integrated in the modified coke. In many cases, integration of these additives requires the increased porosity and improved adsorption characteristics of the coke (e.g., with feedstocks traditionally producing shot coke) created by the methods and process means of the present invention. Thus, the methods of the current invention to produce porous sponge coke and further increase coke porosity and adsorption characteristics for the purpose of adding favorable chemical compounds (e.g., sulfur adsorbents) for fuel coke are distinguished over the coking feedstock dillution method of Gamson's expired patent to reduce asphaltenes content below about 13% and promote the production of sponge coke for the manufacture of graphite and carbon electrodes used in the aluminum industry The current invention distinguishes over Gamson not only in methods, but also as a different purpose or new use. At the very least, the Applicant respectfully submits that the current invention represents a new use of Gamson's expired patent.

The Applicant respectfully submits that DE 19540780A1 teaches a method for quenching coke with an aqueous solution, but not within the thermal cracking process of this application nor for a similar purpose or use. Essentially, DE 19540780A1 teaches the use of a specific quench solution for the purpose of reducing emissions of organic impurities and sulfides from a specific quench process that uses biologically-cleaned process water and waste water from the cooling circuit refreshment system on an unspecified coke operation. More specifically, DE 19540780A1 teaches a method for quenching coke with an aqueous salt solution containing specific concentrations of iron (II) and iron (III) ions and a monoester disodium salt of succinic acid with oxyethylenenonyl phenol. The resulting foamed suspension of water and air mixture from the coke is subjected to one or more steps of flow-through condensation and expansion, which causes the coagulation of organic impurities and the collection of these organic impurities with sulfide compounds and water droplets. Thus, the addition of the these chemicals in this quench is apparently for the purpose of coagulating organic impurities from biologically cleaned process water (used as quench water) to reduce environmental emissions of this particular quench process, NOT for the specific purpose of integrating at least one chemical compound for improving (1) the pet coke's combustion characteristics and/or (2) the environmental impacts of the combustion of this modified pet coke. In contrast, the claim language of independent claim 1 in this application states "whereby said at least one chemical compound substantially

improves the fuel properties, combustion characteristics, or environmental impacts of said sponge coke when used in a combustion process." The chemical compounds in the specific quench solution of DE 19540780A1 (i.e., monoester disodium salts of succinic acid with oxyethylenenonyl phenol and iron ions) would not be effective as a sulfur adsorbent nor have significant impacts on combustion or ash characteristics of the resulting coke due to their chemical nature. Thus, the Applicant respectfully submits this claim language distinguishes over the process disclosed by DE 19540780A1.

Furthermore, the Applicant respectfully submits that DE 19540780A1 does NOT teach the integration of chemical compounds within a porous crystalline structure of the unspecified coke. In fact, the chemical compounds in its specified quench solution do not even remain with the product coke. As disclosed in this application, these types of chemical compounds described in DE 19540780A1 would be difficult to integrate within the porous coke within coke drums due to their large physical structure. In other words, quenching coke in a closed vessel that relies on a fluid flowing through macropores, mesopores, and micropores within the coke is far different from quenching coke in other processes (e.g., quenching fluid flowing over crushed coke). Language in independent claim 1 states "adding at least one chemical compound of predetermined quality and predetermined quantity to said sponge coke in a coke quenching portion of said thermal cracking process wherein the increased porosity or improved adsorption characteristics

aid in the addition of said at least one chemical compound[.]" Claim 17 includes similar language. In this regard, the only way the increased porosity or improved adsorption characteristics can aid in the addition of said at least one chemical compound is if the chemical compound is adsorbed on the internal surface of the porous, sponge coke. As such, the specific type of coke quench operation in DE 19540780A1 is critical to its relevance. In any case, this claim language further distinguishes over the process disclosed by DE 19540780A1. As such, the Applicant respectfully submits the independent claims of the current invention distinguish over DE 19540780A1. Consequently, all claims distinguish over DE 19540780A1.

The Applicant respectfully submits that DE 19540780A1 does NOT teach or specify the type of coke quench operation in this referenced patent. However, the 700 – 1000 °C temperatures (i.e. 1292 – 1832 °F) of the unquenched coke in this referenced patent indicate that the coke that is being quenched is likely from a coal-coking process or a low temperature coke calciner, and not within the quench step of the thermal cracking process of this application, wherein coke temperatures prior to quench are in the range of 400 – 500 °C (i.e., 752 – 932 °F). DE 19540780A1 does not specify what type of 'coking process' is involved, if any. In any case, the methods described in DE 19540780A1 apparently do not teach the controlled injection of selected chemical compounds (e.g., sulfur adsorbents) via quenching coke within the quench portion of the thermal cracking process in the current invention.

In summary, DE 19540780A1 does not teach a step of integrating at least one chemical compound within the coke structure during the quenching step of the thermal cracking process of this application. In fact, the chemical compounds in its specified quench solution do not even remain with the product coke, Furthermore, DE 19540780A1 uses a specific quench solution (vs. those of the current invention) for a very different purpose: reducing environmental emissions from the coke quench on a specific coke quench application due to the use of biologically cleaned process water (vs. substantially improving the fuel properties, combustion characteristics, or environmental impacts of said sponge coke when used in a combustion process as stated in independent claim 1 of the current invention). Finally, the methods described by DE 19540780A1 apparently do not teach the controlled integration of selected chemical compounds (e.g., sulfur adsorbents) via quenching coke within the quench step of the thermal cracking process of the current invention. Consequently, the Applicant respectively submits that the methods of the current invention which provide controlled integration of selected chemical compounds via coke quench for the specific purpose of improving the pet coke's combustion characteristics and environmental impacts are distinguished over the quenching of coke with an aqueous solution of different types of salts in a different type of coke operation for a different purpose or use of DE 19540780A1. Furthermore, the claim language of the independent claims of the current invention distinguish over DE 19540780A1. Consequently, all claims of the

current invention distinguish over DE 19540780A1

The Applicant respectfully submits that the combination suggested by the Examiner would not be obvious to one skilled in the art. The combination of the production of sponge coke via Gamson (US-PAT-NO: 3,684,697) and the coke quench system with aqueous salt solutions of DE 19540780A1 is submitted to be improper because this combination would not teach the claims of this invention. As discussed above, DE 19540780A1 does not add chemical compounds to the product coke and does not disclose any advantage in doing so, particularly for the end-use of the resultant coke. Furthermore, neither Gamson nor DE 19540780A1 suggest such a combination, and one skilled in the art would have no reason to make such a combination. Gamson does not teach or suggest a thermal cracking process or method to produce a sponge coke and further increase the porosity and improve adsorption characteristics to add additional chemical compounds to improve coke fuel properties, combustion characteristics, and environmental impacts. Likewise, DE 19540780A1 does not teach or suggest a controlled, uniform integration of desirable additives via the thermal cracking process quench. Futhermore, neither Gamson nor DE 19540780A1 teach or suggest the potential use of increased porosity and improved adsorption characteristics of the coke produced to add chemical compounds to the coke in the quenching portion of the thermal cracking process. Accordingly, there is no motivation in the prior art to combine the references as suggested by the Examiner, and the

proposed combination of these references still does not teach or suggest every limitation of the present invention. Also, the Applicant respectfully submits that the combination of these referenced patents would NOT be obvious to ones skilled in the art, since the coke operation of DE 19540780A1, as stated above, is not even the same coke process as the delayed coking process of Gamson. Finally, the Applicant's own experience has demonstrated this combination is not obvious to ones skilled in the art. The Applicant is working with experienced coker process engineers at refineries that have been using coking feedstocks which normally produce shot coke with traditional coking operations of the prior art. None of them use the expired patented technology of Gamson to convert shot coke to sponge coke production. Yet, these coker process engineers have asked the Applicant to make this conversion and also inject the additives of the present invention. In addition, one coker process engineer has successfully tested principles of the current invention (with permission & assistance of the Applicant) to temporarily change from shot coke to sponge coke production in their commercial unit, while using a coking feedstock that normally produces shot coke with traditional coking operations of the prior art. Thus, this combination of references is clearly not obvious to ones skilled in the art.

In conclusion, the Applicant respectfully submits that the novel thermal cracking process options and methods of the current invention are (1) unobvious to one skilled in the art and (2) these distinctions of the present invention provide surprising and

unexpected results and are patentable under Section 103 because the increased porosity and improved adsorption characteristics of the modified sponge coke allow the integration of various desirable chemical compounds (e.g., sulfur adsorbents, high quality VCM, and oxygen-containing hydrocarbons) during the quench of the thermal cracking process (e.g., delayed coking) which can improve the coke's fuel properties, combustion characteristics, and environmental impacts. Therefore, Gamson and DE 19540780A1 provide no motivation to combine or modify the references as suggested by the Examiner in order to arrive at the claimed invention. Only after the knowledge presented in the specification of the current invention (e.g., novel principles of how these chemical compounds improve the pet coke's fuel properties, combustion characteristics, and environmental controls) can the uniform integration of desirable chemical compounds in a porous coke crystalline structure produce the new and unexpected results of the current invention.

Claims 9 and 18 are NOT obvious over Gamson (US-PAT-NO: 3,684,697) in view of DE 19540780A1 and Wasson et al. (US-PAT-NO: 4,388,152). The Applicant respectfully submits that Gamson (US-PAT-NO: 3,684,697) claims a method to promote the production of traditional, sponge coke in the delayed coking process, but does not teach the methods or additional limitations of this application. Furthermore, this reference patent does not teach the production of sponge coke for a similar

purpose or use. Some or all of the specific arguments regarding Gamson in the previous section (i.e., rejection of claims 1-3, 7, 8, 10-17, 19-29, and 33-56) are also valid for this section concerning the rejection of claims 9 and 18. However, for the sake of brevity the key points of that discussion can be summarized as follows: (1) Gamson does NOT teach methods (primarily operating conditions) to maintain the proper ratio of asphaltic coking to thermal (aromatics) coking to produce sponge coke preferentially over shot coke for a given process feed; Gamson's primary method does NOT control the coke quality via thermal cracking process operating conditions, primarily reducing the coke drum temperature (e.g., lower heater outlet temperature and/or coking cycle quench); (2) Gamson does NOT teach <u>further</u> increasing the VCM levels, porosity, and adsorption characteristics above and beyond traditional, sponge coke by other process means; (3) Gamson does NOT teach methods (see claim 46) that include the addition of certain 'additives' to affect the coking mechanisms, NOT the asphaltene concentration in the feed; and (4) Gamson does NOT teach producing a porous, sponge coke for the addition of other chemical compounds (e.g., sulfur adsorbents) for the specific purpose of improving the pet coke's combustion characteristics and environmental impacts. In contrast, the current invention specifically discusses these issues in its specification and clearly differentiates over Gamson in all these regards. Thus, the methods of the current invention to produce porous sponge coke <u>and</u> further increase coke VCM, porosity, and adsorption characteristics for the purpose of adding

favorable chemical compounds (e.g., sulfur adsorbents) for fuel coke are distinguished over the coking feedstock dillution method of Gamson's expired patent to reduce asphaltenes content below about 13% and promote the production of sponge coke for the manufacture of graphite and carbon electrodes used in the aluminum industry. The current invention distinguishes over Gamson not only in methods, but also as a different purpose or new use. At the very least, the Applicant respectfully submits that the current invention represents a new use of Gamson's expired patent. In independent claim 1 of the current invention, the claim language provides a step to "promote the production of sponge coke" (i.e., traditional, sponge coke). An additional step is included for "increasing porosity or improving adsorption characteristics of said sponge coke by a process means in said thermal cracking process" (i.e., above and beyond traditional, sponge coke; NOT vs. shot coke). Claim 17 includes similar limitations. Thus, the Applicant respectfully submits that this claim language distinguishes over the process disclosed by Gamson. Furthermore, all claims of the current invention are distinguished over Gamson, since the independent claims of the current invention are distinguished over Gamson,.

The Applicant respectfully submits that DE 19540780A1 teaches a method for quenching coke with an aqueous solution, but not within the thermal cracking process of this application nor for a similar purpose or use. Some or all of the specific arguments regarding DE 19540780A1 in the previous section (i.e., rejection of claims 1-

3, 7, 8, 10-17, 19-29, and 33-56) are also valid for this section concerning the rejection of claims 9 and 18. However, for the sake of brevity the key points of that discussion can be summarized as follows: (1) DE 19540780A1 does not teach a step of integrating at least one chemical compound within the coke structure during the quenching step of the thermal cracking process of this application; in fact, the chemical compounds in its specified quench solution do not even remain with the product coke; (2) DE 19540780A1 uses a specific quench solution (vs. those of the current invention) for a very different purpose: reducing environmental emissions from the coke quench on a specific coke quench application due to the use of biologically cleaned process water (vs. substantially improving the fuel properties, combustion characteristics, or environmental impacts of said sponge coke when used in a combustion process as stated in independent claim 1 of the current invention); and (3) the methods described by DE 19540780A1 apparently do not teach the controlled integration of selected chemical compounds (e.g., sulfur adsorbents) via quenching coke within the quench step of the thermal cracking process of the current invention. In contrast, the language of independent claim 1 in this application states "adding at least one chemical compound of predetermined quality and predetermined quantity to said sponge coke in a coke quenching portion of said thermal cracking process wherein the increased porosity or improved adsorption characteristics aid in the addition of said at least one chemical compound" (a similar limitation is included in claim 17) and "whereby said at

least one chemical compound substantially improves the fuel properties, combustion characteristics, or environmental impacts of said sponge coke when used in a combustion process." Consequently, the Applicant respectively submits that the methods of the current invention, which include controlled integration of selected chemical compounds via coke quench for the specific purpose of improving the pet coke's combustion characteristics and environmental impacts, are distinguished over the quenching of coke with an aqueous solution of different types of salts in a different type of coke operation for a different purpose or use in DE 19540780A1. Furthermore, the claim language of the independent claims of the current invention distinguish over DE 19540780A1. Consequently, all claims of the current invention distinguish over DE 19540780A1.

The Applicant respectfully submits that Wasson et al. (US-PAT-NO: 4,388,152) teaches a modified delayed coking system that integrates vertical coke calcining and briquetting subsystems to produce a desulfurized, blast furnace coke for use in the metals industry. Wasson et al. discloses the desalting of the feed to a coking zone (Col. 2; lines 43-58), but teaches nothing new about desalting technology. "The operation of desalting vessels is well-known to those skilled in the art and does not constitute a part of the present invention" (Col. 2; Lines 52-54). As such, Wasson et al. discloses nothing more than a standard crude oil desalting system. Furthermore, Wasson et al. does not teach specific salt removal performance that typically requires

improvements of the standard crude oil desalting system. In contrast, the specification of the current invention describes various means (e.g., additional desalting stages) to improve the salt removal efficiencies of the standard crude oil desalting system. The Applicant does not claim to be the first to produce a crude oil desalting system. The specification also discusses the rationale for minimizing the salt levels (e.g., sodium) in the coke precursor material to promote porous, sponge coke with desirable porosity and adsorption properties. Thus, claims 9 and 18 reflect specific, achievable concentrations that are desirable to achieve these objectives. Consequently, the Applicant respectfully submits that Wasson et al. may disclose the need for the desalting of a feed to a coking zone, but does NOT teach crude oil desalting systems that have the superior performance and limitations of the current invention.

The Applicant respectfully submits that the combination suggested by the Examiner would not be obvious to one skilled in the art. The combination of (1) the production of sponge coke via Gamson (US-PAT-NO: 3,684,697), (2) the coke quench system with aqueous salt solutions of DE 19540780A1, and (3) the desalting system of Wasson et al. (US-PAT-NO: 4,388,152) is submitted to be improper because this combination still would not teach the claims of this invention. As discussed above, DE 19540780A1 does not add chemical compounds to the product coke and does not disclose any advantage in doing so, particularly for the end-use of the resultant coke. Also, neither Gamson nor DE 19540780A1 nor Wasson et al. suggest such a

combination, and one skilled in the art would have no reason to make such a combination. Gamson does not teach or suggest a thermal cracking process or method to produce a sponge coke and further increase the porosity and improve adsorption characteristics to add additional chemical compounds to improve coke fuel properties, combustion characteristics, and environmental impacts. Likewise, DE 19540780A1 does not teach or suggest a controlled, uniform integration of desirable chemical compounds via the thermal cracking process quench of the current invention. In addition, Wasson et al. may disclose the need for the desalting of a feed to a coking zone, but does not teach crude oil desalting systems that have the superior performance and limitations of the current invention. Futhermore, neither Gamson nor DE 19540780A1 nor Wasson et al. teach or suggest the potential use of increased porosity and improved adsorption characteristics of the coke produced to add chemical compounds to the coke in the quenching portion of the thermal cracking process. Accordingly, there is no motivation in the prior art to combine the references as suggested by the Examiner, and the proposed combination of these references still does not teach or suggest every limitation of the present invention. Also, the Applicant respectfully submits that the combination of these referenced patents would NOT be obvious to ones skilled in the art, since the coke operation of DE 19540780A1, as stated above, is not even the same coke process as the delayed coking process of Gamson. Finally, the Applicant's own experience has demonstrated this combination is

not obvious to ones skilled in the art. The Applicant is working with experienced coker process engineers at refineries that have been using coking feedstocks which normally produce shot coke with traditional coking operations of the prior art. None of them use the expired patent technology of Gamson to convert shot coke to sponge coke production. Yet, these coker process engineers have asked the Applicant to make this conversion and also inject the additives of the present invention. In addition, one coker process engineer has successfully tested principles of the current invention (with permission & assistance of the Applicant) to temporarily change from shot coke to sponge coke production in their commercial unit, while using a coking feedstock that normally produces shot coke with traditional coking operations of the prior art. Thus, this combination of references is clearly not obvious to ones skilled in the art.

In conclusion, the Applicant respectfully submits that the novel thermal cracking process options and methods of the current invention are (1) unobvious to one skilled in the art and (2) these distinctions of the present invention provide surprising and unexpected results and are patentable under Section 103 because the increased porosity and improved adsorption characteristics of the modified sponge coke allow the integration of various desirable chemical compounds (e.g., sulfur adsorbents, high quality VCM, and oxygen-containing hydrocarbons) during the quench of the thermal cracking process (e.g., delayed coking) which can improve the coke's fuel properties, combustion characteristics, and environmental impacts. Therefore, Gamson, DE

19540780A1, and Wasson et al. provide no motivation to combine or modify the references as suggested by the Examiner in order to arrive at the claimed invention. Only after the knowledge presented in the specification of the current invention (e.g., novel principles of how these chemical compounds can improve the pet coke's fuel properties, combustion characteristics, and environmental controls) can the uniform integration of desirable chemical compounds within a porous coke crystalline structure produce the new and unexpected results of the current invention.

Claims 4-6 and 30-32 are NOT obvious over Gamson (US-PAT-NO: 3,684,697) in view of DE 19540780A1 and Yan (US-PAT-NO: 4,096,097). The Applicant respectfully submits that Gamson (US-PAT-NO: 3,684,697) claims a method to promote the production of traditional, sponge coke in the delayed coking process, but does not teach the methods or additional limitations of this application. Furthermore, this reference patent does not teach the production of sponge coke for a similar purpose or use. Some or all of the specific arguments regarding Gamson in the first 103 section (i.e., rejection of claims 1-3, 7, 8, 10-17, 19-29, and 33-56) are also valid for this section concerning the rejection of claims 4-6 and 30-32. However, for the sake of brevity the key points of that discussion can be summarized as follows: (1) Gamson does NOT teach methods (primarily operating conditions) to maintain the proper ratio of asphaltic coking to thermal (aromatics) coking to produce sponge coke preferentially

over shot coke for a given process feed; Gamson's primary method does NOT control the coke quality via thermal cracking process operating conditions, primarily reducing the coke drum temperature (e.g., lower heater outlet temperature and/or coking cycle quench); (2) Gamson does NOT teach further increasing the VCM levels, porosity, and adsorption characteristics of above and beyond traditional, sponge coke by other process means; (3) Gamson does NOT teach methods (see claim 46) that include the addition of certain 'additives' to affect the coking mechanisms, NOT the asphaltene concentration in the feed; and (4) Gamson does NOT teach producing a porous, sponge coke for the addition of other chemical compounds (e.g., sulfur adsorbents) for the specific purpose of improving the pet coke's combustion characteristics and environmental impacts. In contrast, the current invention specifically discusses these issues in its specification and clearly differentiates over Gamson in all these regards. Thus, the methods of the current invention to produce porous sponge coke and further increase coke VCM, porosity, and adsorption characteristics for the purpose of adding favorable chemical compounds (e.g., sulfur adsorbents) for fuel coke are distinguished over the coking feedstock dillution method of Gamson's expired patent to reduce asphaltenes content below about 13% and promote the production of sponge coke for the manufacture of graphite and carbon electrodes used in the aluminum industry. The current invention distinguishes over Gamson not only in methods, but also as a different purpose or new use. At the very least, the Applicant respectfully submits that the

current invention represents a new use of Gamson's expired patent. In independent claim 1 of the current invention, the claim language provides a step to "promote the production of sponge coke" (i.e., traditional, sponge coke). An additional step is included for "increasing porosity or improving adsorption characteristics of said sponge coke by a process means in said thermal cracking process" (i.e., above and beyond traditional, sponge coke; NOT vs. shot coke). Claim 17 includes similar limitations. Thus, the Applicant respectfully submits that this claim language distinguishes over the process disclosed by Gamson. Furthermore, all claims of the current invention are distinguished over Gamson, since the independent claims of the current invention are distinguished over Gamson,.

The Applicant respectfully submits that DE 19540780A1 teaches a method for quenching coke with an aqueous solution, but not within the thermal cracking process of this application nor for a similar purpose or use. Some or all of the specific arguments regarding DE 19540780A1 in the first 103 section (i.e., rejection of claims 1-3, 7, 8, 10-17, 19-29, & 33-56) are also valid for this section concerning the rejection of claims 4-6 and 30-32. However, for the sake of brevity the key points of that discussion can be summarized as follows: (1) DE 19540780A1 does not teach a step of integrating at least one chemical compound within the coke structure during the quenching step of the thermal cracking process of this application; in fact, the chemical compounds in its specified quench solution do not even remain with the product coke;

(2) DE 19540780A1 uses a specific quench solution (vs. those of the current invention) for a very different purpose: reducing environmental emissions from the coke quench on a specific coke quench application due to the use of biologically cleaned process water (vs. substantially improving the fuel properties, combustion characteristics, or environmental impacts of said sponge coke when used in a combustion process as stated in independent claim 1 of the current invention); and (3) the methods described by DE 19540780A1 apparently do not teach the controlled integration of selected chemical compounds (e.g., sulfur adsorbents) via quenching coke within the quench step of the thermal cracking process of the current invention. In contrast, the claim language of independent claim 1 in this application states "adding at least one chemical compound of predetermined quality and predetermined quantity to said sponge coke in a coke quenching portion of said thermal cracking process wherein the increased porosity or improved adsorption characteristics aid in the addition of said at least one chemical compound" (claim 17 includes a similar limitation) and "whereby said at least one chemical compound substantially improves the fuel properties, combustion characteristics, or environmental impacts of said sponge coke when used in a combustion process." Consequently, the Applicant respectively submits that the methods of the current invention, which include controlled integration of selected chemical compounds via coke quench for the specific purpose of improving the pet coke's combustion characteristics and environmental impacts, are distinguished over

the quenching of coke with an aqueous solution of different types of salts in a different type of coke operation for a different purpose or use in DE 19540780A1. Furthermore, the claim language of the independent claims of the current invention distinguish over DE 19540780A1. Consequently, all claims of the current invention distinguish over DE 19540780A1.

The Applicant respectfully submits that Yan (US-PAT-NO: 4,096,097) teaches a method for the preferential formation of sponge coke (vs. shot coke) suitable for use in the manufacture of electrodes via improved grindability characteristics. In addition, Yan does not suggest using carbon adsorption properties of the modified coke without removal from the coke drum and further treatment. In contrast, the Applicant incorporates the principles of this expired patent in the specification of the current invention in a novel combination of methods and "new use" for increasing the porosity and adsorption character of the coke to improve the ability to uniformly distribute desirable chemical compounds into the resultant modified coke. In turn, uniform integration of these chemical compounds has the objective of improving the fuel properties, combustion characteristics, and/or environmental impacts of the modified coke, not the manufacture of electrodes.

The Applicant respectfully submits that the combination suggested by the Examiner would not be obvious to one skilled in the art. The combination of (1) the production of sponge coke by dilution of asphaltenes in the feed material via Gamson

(US-PAT-NO: 3,684,697), (2) the coke quench system with aqueous salt solutions via DE 19540780A1, and (3) the addition of carbonaceous material to the feed material to promote sponge coke via Yan (US-PAT-NO: 4,096,097) is submitted to be improper because this combination would not teach the claims of this invention. As discussed above, DE 19540780A1 does not add chemical compounds to the product coke and does not disclose any advantage in doing so, particularly for the end-use of the resultant coke. Furthermore, neither Gamson nor DE 19540780A1 nor Yan suggest such a combination, and one skilled in the art would have no reason to make such a combination. Gamson and Yan do not teach or suggest a thermal cracking process or method to produce a sponge coke and further increase the porosity and improve adsorption characteristics to add additional chemical compounds to improve coke fuel properties, combustion characteristics, and environmental impacts. Likewise, DE 19540780A1 does not teach or suggest a controlled, uniform integration of desirable chemical compounds via the thermal cracking process quench. Futhermore, neither Gamson nor DE 19540780A1 nor Yan teach or suggest the potential use of increased porosity and improved adsorption characteristics of the coke produced to add chemical compounds to the coke in the quenching portion of the thermal cracking process. Accordingly, there is no motivation in the prior art to combine the references as suggested by the Examiner, and the proposed combination of these references still does not teach or suggest every limitation of the present invention. Also, the Applicant

respectfully submits that the combination of these referenced patents would NOT be obvious to ones skilled in the art, since the coke operation of DE 19540780A1, as stated above, is not even the same coke process as the delayed coking process of Gamson. Finally, the Applicant's own experience has demonstrated this combination is not obvious to ones skilled in the art. The Applicant is working with experienced coker process engineers at refineries that have been using coking feedstocks which normally produce shot coke with traditional coking operations of the prior art. None of them use the expired patented technology of Gamson or Yan to convert shot coke to sponge coke production. Yet, these coker process engineers have asked the Applicant to make this conversion and also inject the additives of the present invention. In addition, one coker process engineer has successfully tested principles of the current invention (with permission & assistance of the Applicant) to temporarily change from shot coke to sponge coke production in their commercial unit, while using a coking feedstock that normally produces shot coke with traditional coking operations of the prior art. Thus, this combination of references is clearly not obvious to ones skilled in the art.

In conclusion, the Applicant respectfully submits that the novel thermal cracking process options and methods of the current invention are (1) unobvious to one skilled in the art and (2) these distinctions of the present invention provide surprising and unexpected results and are patentable under Section 103 because the increased porosity and improved adsorption characteristics of the modified sponge coke allow the

integration of various desirable chemical compounds (e.g., sulfur adsorbents, high quality VCM, and oxygen-containing hydrocarbons) during the quench of the thermal cracking process (e.g., delayed coking) which can improve the coke's fuel properties, combustion characteristics, and environmental impacts. Therefore, Gamson, DE 19540780A1, and Yan provide no motivation to combine or modify the references as suggested by the Examiner in order to arrive at the claimed invention. Only after the knowledge presented in the specification of the current invention (e.g., novel principles of how these additives improve the pet coke's fuel properties, combustion characteristics, and environmental controls) can the uniform integration of desirable additives in a porous coke crystalline structure produce the new and unexpected results of the current invention.

The Applicant respectfully submits that none of these cited references teaches the potential use of increased porosity and improved adsorption characteristics of a modified pet coke to add chemical compounds to the coke in the quenching portion of the thermal cracking process. The Applicant respectfully submits that any combination of these cited references would not be obvious to one skilled in the art. The combination of sponge coke production by dilution of asphaltenes or addition of carbonaceous material in the feed material and a coke quench system with aqueous salt solutions is submitted to be improper because none of the cited references suggest such a combination, and one skilled in the art would have no reason to make such a

combination. Furthermore, none of the cited references teach or suggest the potential use of increased porosity and improved adsorption characteristics of a modified coke to integrate various desirable chemical compounds (e.g., sulfur adsorbents, high quality VCM, and oxygen-containing hydrocarbons) during the quench portion of the thermal cracking process (e.g., delayed coking) for improving the coke's fuel properties, combustion characteristics, and environmental impacts. Accordingly, there is no motivation in the prior art to combine the references as suggested by the Examiner, and the proposed combination of these references still does not teach or suggest every limitation of the present invention. These distinctions of the present invention provide surprising and unexpected results and are patentable under Section 103 because the improved adsorption characteristics of the modified coke allow the integration of various desirable chemical compounds (e.g., sulfur adsorbents, high quality VCM, and oxygen-containing hydrocarbons) during the quench of the thermal cracking process (e.g., delayed coking) which can improve the coke's fuel properties, combustion characteristics, and environmental impacts. Therefore, none of the cited references provide any motivation to combine or modify the references as suggested by the Examiner in order to arrive at the claimed invention.

Since the novel physical features of the Applicant's modified petroleum coke provide these new and unexpected results over any reference, the Applicant submits that these new results indicate unobviousness and hence patentability. Therefore, the

Applicant respectfully submits that no combination of the cited references can support the rejection of claims 1-56 under 35 U.S.C. § 103(a). Accordingly, the Applicant respectfully requests reconsideration and allowance of the present application with the existing claims.

Double Patenting

Claims 1-3, 7-29, and 33-56 were rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-5, 11, 12, and 15-21 of U.S. Patent No. 6,168,709 in view of DE 19540780A1. Claims 1-56 were provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 19-33 of copending Application No. 09/763282. The Applicant respectfully traverses these rejections.

The Applicant respectfully submits that the current invention is patentable over claims 1-5, 11, 12, and 15-21 of U.S. Patent No. 6,168,709 in view of DE 19540780A1. The Applicant respectfully submits that Etter (US-PAT-NO: 6,168,709) teaches a method to promote the production of traditional, sponge coke in the thermal cracking process, but does not teach the methods or additional limitations of this application. U.S. Patent No. 6,168,709 does NOT teach further increasing the porosity and adsorption characteristics above and beyond traditional, sponge for the addition of other chemical compounds (e.g., sulfur adsorbents) for the specific purpose of

improving the pet coke's combustion characteristics and environmental impacts. In independent claim 1 of the current invention, the claim language provides a step to "promote the production of sponge coke" (i.e. traditional, sponge coke). An additional step is included for "increasing porosity or improving adsorption characteristics of said sponge coke by a process means in said thermal cracking process" (i.e., above and beyond traditional, sponge coke; NOT vs. shot coke). Claim 17 includes similar limitations. Thus, the Applicant respectfully submits that this claim language distinguishes over the process disclosed by U.S. Patent No. 6,168,709. Furthermore, all claims of the current invention are distinguished over U.S. Patent No. 6,168,709, since the independent claims of the current invention are distinguished over U.S. Patent No. 6,168,709,

The Applicant respectfully submits that DE 19540780A1 teaches a method for quenching coke with an aqueous solution, but not within the thermal cracking process of this application nor for a similar purpose or use. Some or all of the specific arguments regarding DE 19540780A1 in the first 103 section (i.e., rejection of claims 1-3, 7, 8, 10-17, 19-29, & 33-56) are also valid for this section concerning the rejection of claims 1-3, 7-29, and 33-56. However, for the sake of brevity the key points of that discussion can be summarized as follows: (1) DE 19540780A1 does not teach a step of integrating at least one chemical compound within the coke structure during the quenching step of the thermal cracking process of this application; in fact, the chemical

compounds in its specified quench solution do not even remain with the product coke; (2) DE 19540780A1 uses a specific quench solution (vs. those of the current invention) for a very different purpose: reducing environmental emissions from the coke quench on a specific coke quench application due to the use of biologically cleaned process water (vs. substantially improving the fuel properties, combustion characteristics, or environmental impacts of said sponge coke when used in a combustion process as stated in independent claim 1 of the current invention); and (3) the methods described by DE 19540780A1 apparently do not teach the controlled integration of selected chemical compounds (e.g., sulfur adsorbents) via quenching coke within the quench step of the thermal cracking process of the current invention. In contrast, the claim language of independent claim 1 in this application states "adding at least one chemical compound of predetermined quality and predetermined quantity to said sponge coke in a coke quenching portion of said thermal cracking process wherein the increased porosity or improved adsorption characteristics aid in the addition of said at least one chemical compound" (claim 17 includes a similar limitation) and "whereby said at least one chemical compound substantially improves the fuel properties, combustion characteristics, or environmental impacts of said sponge coke when used in a combustion process." Consequently, the Applicant respectively submits that the methods of the current invention, which include controlled integration of selected chemical compounds via coke quench for the specific purpose of improving the pet

coke's combustion characteristics and environmental impacts, are distinguished over the quenching of coke with an aqueous solution of different types of salts in a different type of coke operation for a different purpose or use in DE 19540780A1. Furthermore, the claim language of the independent claims of the current invention distinguish over DE 19540780A1. Consequently, all claims of the current invention distinguish over DE 19540780A1.

Furthermore, neither of the cited references provides any motivation to combine or modify the references as suggested by the Examiner in order to arrive at the claimed invention. Therefore, the Applicant respectfully submits that claims 1-5, 11, 12, and 15-21 of U.S. Patent No. 6,168,709 in view of DE 19540780A1 cannot support the rejection of claims 1-3, 7-29, and 33-56 of the current invention under the obviousness-type double patenting doctrine.

Claims 1-56 were provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 19-33 of copending Application No.09/763,282. The Applicant respectfully submits that claims 19-33 of copending Application No. 09/763,282 do not contain the added step of this invention to further increase the porosity and improve adsorption characteristics of the coke prior to adding other chemical compounds (e.g., sulfur adsorbents) in the coking quench portion of the thermal cracking process (e.g., delayed coking). That is, the independent claims (i.e., claims 1 and 17) of this invention add further process means

to increase porosity and improve adsorption characteristics of the coke prior to the coke quench. Thus, the Applicant respectfully submits that the independent claims of this invention contain additional claim language with respect to this additional step involving a process means in the thermal cracking process for improving porosity and/or adsorption characteristics prior to the addition of other chemical compound(s) in the coke quench portion of the process. This additional claim language distinguishes independent claims of the current application over the claims of copending Application No. 09/763,282. Hence, all claims of this invention are distinguished over all the claims of copending Application No. 09/763,282.

Conclusion

The Applicant has distinguished claims 1-56 over the cited references. Therefore, the Applicant respectfully submits that the present application is now in condition for allowance, and such action is earnestly requested. If the present application is still not in condition for allowance, your suggestions for modifications to put the present application in condition for allowance would be greatly appreciated.

Respectfully submitted,

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